
ANIMAL BEHAVIOR AND WELL-BEING I

0032 Associations between bovine respiratory disease complex and the probability and latency of group-reared neonatal dairy calves to approach a novel object or stationary person. M. C. Cramer* and A. L. Stanton, *University of Wisconsin-Madison, Madison.*

Bovine respiratory disease complex (BRD) is an important disease that impacts the welfare and performance of dairy calves. With group housing of calves becoming more common, it is imperative to identify behaviors indicative of illness in a socially competitive environment. The objective of this study was to determine associations between BRD status of group-housed dairy calves and their latency to approach a novel object or stationary person. On a commercial dairy in Wisconsin, 75 Holstein preweaned, group-housed heifer calves were tested once a week for 6 wk. The average age of calves on enrollment was 4.1 ± 1.9 d. Calves were housed in 8 pens with an average of 9 ± 1 calves per pen. Each week, all calves in the study were tested for their willingness to approach a novel object (OBJ) and a stationary person (SP) within 60 s. Approach was defined as 1 step in the direction of SP or OBJ. Pen and test order were randomized. After both OBJ and SP tests were complete, a standardized health assessment was conducted. The behaviors of calves with clinical signs of BRD were compared with calves with no clinical signs of BRD. All models were controlled for week, pen, pen order, and test order. Associations between probability of approach and BRD status were analyzed, using a linear mixed model with a logit transform (PROC GLIMMIX), controlling for calf as a random effect. Calves without BRD were 2.5 (95% CL: 1.4 to 4.6) and 2.6 times (95% CL: 1.4 to 4.8) as likely to approach than calves without BRD for the SP ($P < 0.005$) and OBJ tests ($P < 0.005$), respectively. The latency of calves that approached the SP or OBJ was analyzed using a Cox proportional hazards regression (PROC PHREG). The BRD status did not significantly impact the latency to approach in either test. The median latency to approach was 18 and 9 s for SP and OBJ tests, respectively. Clinical signs of BRD impacted the probability of approach but did not impact the latency to approach, which indicates that BRD influences the willingness to approach but not the rapidity at which a calf approaches. These findings suggest that approach tests may be used to identify calves with BRD in group housing.

Key Words: behavior, BRD, calves

0033 Effect of concentrate feeder design on feeding behavior in Holstein bulls fed high-concentrate diets. M. Verdu¹, A. Bach², and M. Devant¹, ¹IRTA-Department Ruminant Production, Caldes Montbui-Barcelona, Spain, ²Department of Ruminant Production, IRTA, Caldes de Montbui, Spain

A total of 240 Holstein bulls (121 ± 2.0 kg BW and 99 ± 1.0 d of age), in a replicated factorial study, were randomly allocated in 1 of 6 pens and assigned to 1 of the 3 treatments, according to the feeder design: conventional feeder with 4 feeding spaces (CF), conventional feeder with less concentrate capacity (CFL), and a single-space feeder with lateral protections (SF). Also, each pen had 1 straw feeder and 1 drinker. Each feeder was suspended on 4 load cells that registered continuously contained concentrate weight. Feeding pattern was video recorded for 24 h on d 7, 119 to 120, and 215 to 216 of the study, and was analyzed by continuous scan sampling. Only 12 h (from 0600 to 0018 h) were analyzed as the greatest activity was observed during that time window. Data were analyzed using a mixed-effects model with repeated measures. The percentage of concentrate bunk attendance was greater ($P < 0.01$) in SF ($79.3\% \pm 0.75\%$) compared with CF and CFL ($70.2\% \pm 0.75\%$). The number of visits in SF (44.3 ± 17.36) was less ($P < 0.05$) compared with CF and CFL (118.6 ± 17.36). Obviously, the number of bulls at the SF feeder was ($P < 0.01$) 1 and constant throughout the study in contrast with CF and CFL (1.7 ± 0.02), where the number of bulls at the feeder was > 1.5 and decreased with age. No displacements at SF were observed ($P < 0.01$), whereas in the other feeders some displacements at feeder were registered (CF: 2.3 ± 0.51 , CFL: 3.4 ± 0.51 displacements/1 h). The percentage of waiting time at the feeder was greater ($P < 0.01$) in SF ($13.3 \pm 2.18\%$) than CF and CFL ($0.53 \pm 2.18\%$). However, the waiting time at the feeder in SF was reduced ($P < 0.05$) with age. The eating rate increased ($P < 0.05$) with age in all treatments, being greater in CF (205.7 ± 7.84 g/min) than CFL (177.4 ± 7.84 g/min) and SF (151.2 ± 7.84 g/min). In conclusion, the design of the SF, 1 feeding space with lateral barriers, distributes feeder visits throughout the day, decreases displacements at the feeder, and decreases eating rate compared with the conventional feeders. The reduction of concentrate capacity at the feeder increases displacements and decreases concentrate eating rate at the feeder.

Key Words: beef, feeder, feeding behavior

0034 The effect of respiratory disease on lying behavior in Holstein dairy calves. T. L. Ollivett¹, K. E. Leslie^{*1}, D. V. Nydam², T. F. Duffield¹, G. Zobel³, J. Hewson¹, and D. F. Kelton⁴, ¹University of Guelph, ON, Canada, ²Department of Population Medicine and Diagnostic Sciences, Cornell University, Ithaca, NY, ³University of British Columbia, Vancouver, Canada, ⁴Department of Population Medicine, Ontario Veterinary College, University of Guelph, Canada.

The objective of this cohort study was to determine the effect of naturally occurring bovine respiratory disease (BRD) on lying behavior in preweaned Holstein dairy calves. This study was performed on 1 commercial dairy in southwestern Ontario, Canada, during November and December 2012. Calves were enrolled at 10 d of age and were grouped according to vaccination status ($n = 19$ vaccinated and $n = 20$ unvaccinated). Each calf was examined at weekly intervals for signs of BRD before and during the peak 4-wk period when calves are at risk for developing disease. Respiratory scoring (RS) and thoracic ultrasonography (US) were performed at each of the 5 visits. Individual electronic accelerometers recorded lying behavior throughout the 4-wk period. Descriptive statistics and repeated measures linear models were developed using commercially available software. Fever, sickness, and lung consolidation increased from 11%, 3%, and 0%, respectively, at the first examination to 33%, 33%, and 58%, respectively, at the last examination ($P < 0.05$). Overall, calves spent 20.6 ± 0.7 h/d (mean \pm SE) or 86% of the day lying down when all variables were set to the referent. Lying time (LT) decreased by 4 ± 1 min/d for each successive day of age. Fever was associated with 44 ± 14 min/d additional LT. Calves housed in group pens had lower but not statistically significant LT than those housed in single pens. Also, housing type confounded the LT estimate for age. Ultrasonographic lung consolidation and health status ($RS > 4$) were not significantly associated with LT. Lying bout duration (BD) was 72 (61 to 85) min/d (median; IQR) and lying bout frequency (BF) was 16 (13 to 18) bouts per day (median; IQR). Health status and lung consolidation were not significantly associated with BD or BF. Fever numerically increased BD but was not associated with BF. Monitoring LT in preweaned dairy calves might have a place in identifying febrile animals requiring individual examination and possible intervention. Further studies are needed to determine if early identification and treatment of animals experiencing fever improves future health and performance, as compared with traditional methods of disease detection. Lastly, researchers should consider monitoring rectal temperature during behavioral studies to assess for bias due to undetected fevers.

Key Words: accelerometer, dairy calf pneumonia, ultrasonography

0035 Freestall housing during the dry period altered lying time but did not affect milk quality or energy balance compared with pasture. R. A. Black^{*1}, H. M. Dann², and P. D. Krawczel¹, ¹University of Tennessee, Knoxville, ²William H. Miner Agricultural Research Institute, Chazy, NY.

The objective was to determine changes in behavior and performance of cows housed in freestalls or pasture during a 60-d dry period. Non-lactating Holstein cows were assigned to either deep-bedded, sand freestalls ($n = 14$) and grassy pasture ($n = 14$) at stocking densities below industry recommendations using rolling enrollment. At dry off, cows were equipped with an accelerometer to determine daily lying time (h/d), lying bouts (bouts/d), and steps (steps/d). Data were divided into 4 periods relative to calving: FO (d -60 to -15), CU (d -14 to -1), CA (d 0), and PP (d 1 to 14). Cows were scored for BCS (1 = thin, 5 = obese), hygiene (1 = clean, 5 = dirty), locomotion (1 = normal, 5 = severely lame), and weighed 1 wk before dry off, at dry off, at calving, and on d 7 and 14 postpartum. All cows commingled following calving in a pen identical to the freestall housing treatment. Blood samples were analyzed cow side for β -hydroxybutyrate (BHBA) on d 0, 2, 5, 8, 11, and 14. Milk samples collected at the morning milking on d 0, 1, 2, 7, and 14 were analyzed for somatic cell count (SCC), fat, and protein. On d 0, colostrum volume and quality were assessed. Data were analyzed with the MIXED procedure of SAS with model effects for day, treatment, and the interaction of day and treatment. Cows housed in freestalls lay down longer during FO (11.9 ± 0.3 vs. 10.2 ± 0.3 h/d; $P < 0.01$) and CU (12.6 ± 0.3 vs. 10.3 ± 0.3 h/d; $P < 0.01$) periods. Freestall cows had fewer lying bouts during the CA (11.6 ± 0.8 vs. 15.8 ± 0.8 bouts/d; $P < 0.01$) period with no other periods differing. Freestall cows took fewer steps during FO (1844.5 ± 165.1 vs. 2909.4 ± 202.0 steps/d; $P < 0.01$), CU (1714.6 ± 177.0 vs. 2648.8 ± 214.9 steps/d; $P < 0.01$), and CA (2015.8 ± 204.2 vs. 2874.3 ± 245.6 steps/d; $P < 0.01$) periods. Overall, milk fat was greater for freestall cows ($4.9\% \pm 0.2$ vs. $4.1\% \pm 0.2$, respectively; $P < 0.01$). Lower locomotion scores tended to be associated with freestall housing compared with pasture (1.4 ± 0.1 vs. 1.8 ± 0.1 , respectively; $P = 0.06$). No differences in BHBA, colostrum amount and quality, hygiene, SCC, milk protein, BCS, or weight existed between housing treatments ($P > 0.22$). Freestall-housed cows were less active (fewer steps and greater lying times) throughout the dry period; however, this did not affect colostrum or energy balance postpartum. The more important factor (lying time vs. moderate exercise) needs to be established for improved management of dry cows.

Key Words: behavior, dairy cattle, dry cow housing

0036 Health of dairy calves when using automated feeders in the Midwest United States.

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Research is limited regarding best housing and management practices for automated calf feeding systems, particularly in terms of how these factors influence animal health and welfare. This ongoing study is characterizing health scores, morbidity, and mortality of group-housed calves on U.S. farms and relating these to housing and management practices. Thirty-eight dairy farms in the Midwest United States were visited every 60 d. During each visit, calves ($n = 7779$) were scored for health using 4 categories: attitude (0 to 4), ears (0 to 4), nose (0 to 3), eyes (0 to 3), and cleanliness (an indicator of diarrhea, 0 to 2), with 0 representing a normal, healthy calf. In addition, blood was drawn from any calves 1- to 5-d old ($n = 711$) and serum protein concentration was used to assess passive immunity transfer. During each season, milk samples were collected from the mixing container inside the feeder and the tube leading to the nipple for measurement of standard plate count (SPC) and coliform count. Pearson's correlation coefficient was used to analyze the relationship between mean SPC and health scores. There was a large variation among farms in calf health. On the 10 farms with the best health scores, a mean of 9.7% (range of 2.9 to 12.9) of animals displayed abnormal scores for attitude, 3.7% (1.7 to 5.1) for ears, 12.2% (7.8 to 14.8) for nose, 7.2% (2.0 to 11.9) for eyes, and 26.4% (20.1 to 32.6) for cleanliness. On the 10 farms with the worst health scores, a mean of 22.8% (15.7 to 30.3) of animals displayed abnormal scores for attitude, 14.4% (10.0 to 22.5) for ears, 27.2% (22.8 to 30.6) for nose, 30.3% (22.5 to 36.4) for eyes, and 54.9% (50.6 to 60.3) for cleanliness. Mean serum protein across all samples was 5.40 ± 0.74 mg/dl. Mean serum protein by farm was 5.34 mg/dl (minimum = 4.27, maximum = 6.5). The highest overall bacterial counts were recorded in feeder tube samples (median, coliform = 2550 CFU/ml; SPC = 330,000 CFU/ml; Q3 = 3350,000). No relationship was observed between tube SPC and attitude, ears, nose, or eyes scores; however, SPC was correlated with calf cleanliness scores ($r = 0.26$, $P = 0.002$). The variation in health scores among farms shows that welfare in automated feeder systems can be improved. In addition, results indicate that the cleanliness of automated feeder equipment may influence calf health; however, further data collection and analyses of calf morbidity and mortality should provide a more complete understanding of risk factors. This project is supported by Agriculture and Food Research Initiative competitive grant no. 2012-67021-19280 from the USDA National Institute of Food and Agriculture.

Key Words: automated calf feeders, calf health

0037 Effect of heat retaining covers on calf hutch temperature during cold weather. J. A. Haberman*, T. H. Friend, and W. Binion, *Texas A&M University, College Station.*

Previous studies have demonstrated that reflective hutch covers reduce temperatures inside calf hutches, but the efficacy of reflective covers during cold weather has yet to be determined. This study determined the effect of heat-retaining covers on the internal air temperature of polyethylene calf hutches. Treatments on farm 1 included an aluminized 3.0-ml, black, low-density polyethylene (LDPE; reflective) and a 4.0-ml, LDPE (non-reflective) cover. Farm 2 included only the reflective cover. The covers fit over the top of the hutch, overlaying the top, sides, and back, leaving the front of the hutch exposed. The study was conducted for a 29-d period from December to January at 2 dairy farms located near Plainview, TX. At both farms, 5 uncovered (control) hutches and 5 hutches from each treatment were fitted with duplicate temperature loggers that recorded temperature every 30 min for the duration of the study. At the start of the study, hutches housed calves 2 to 4 d of age. The coldest 2-h period was identified and treatment effects were determined with ANOVA and LSD. At farm 1, the reflective covers were warmer than control hutches by 1.5°C ($P < 0.01$) and the non-reflective covers were warmer than the control by 1.2°C ($P < 0.01$). At farm 2, the reflective covers were warmer than the control by 1.5°C ($P < 0.05$). This period was also characterized by very little wind. When the coldest ambient temperature each day throughout the study was identified, covers were not significantly different than the control ($P > 0.05$) on both farms. This emphasizes the importance of wind influencing air temperature in the hutch. However, there was still a consistent trend on both farms in which the reflective cover was warmer by 1.16°C on farm 1 and 1.5°C on farm 2. In conclusion, the reflective cover was more effective and the hutch covers had the greatest effect on internal air temperature in low wind. The heat-retaining covers in this study can be expected to improve the comfort of calves in cold temperatures; however, the biological significance of these covers is currently being investigated.

Key Words: cold stress, dairy calf, hutch

0038 Modeling the effect of reflective film calf hutch covers on reducing heat loss. W. Binion* and T. H. Friend, *Texas A&M University, College Station.*

Many dairy operations are located in environments subject to periods of cold weather and calf hutches are a popular method of protecting calves from environmental extremes. This study determined if a reflective film could be useful in moderating the rate of heat loss from calves housed in polyethylene hutches during cold weather. An engineering approach was

used in which rate of heat loss was modeled, using 38-l, water-filled, steel drums covered by a yearling cow hide. Hides were collected the day before and cut to fit the drums so no metal was exposed. Duplicate loggers mounted in the center of each drum recorded temperature at 5-min intervals during each experiment. Two agitators circulated the water inside each drum. The reflective film (cover) consisted of aluminized 2.5-ml, low-density polyethylene, full metal on olive color, with flat black spray paint covering the olive. The covers were 1.8- × 3-m finished size with the aluminized side facing the hutch and paint facing outward. Two of 4 hutches were either uncovered or had covers across the top and sides of the hutch, leaving the front and back exposed. Water temperature ranged from 43.3°C to 32.2°C and there was an average 24 data points per experiment. Data loggers in each drum were averaged at each 5-min interval and averaged within treatments, and quadratic regression was used to predict rate of heat loss. During the cold night experiment, when ambient

temperature was declining (mean temperature -13.6°C), the mean rate of temperature loss was -0.21°C per 5-min interval in the covered and -0.25°C in the uncovered ($R^2 = 0.99$). During the daytime trial when the sun was shining and ambient temperature was rising (mean 14.3°C), mean rate of heat loss was -0.15°C per 5-min interval in the covered and -0.11°C in the uncovered ($r^2 = 0.99$). Reflective film does appear to have potential to reduce the rate of heat loss when calves would be most at risk, cold nights. When the sun was shining on the hutches during mid-day, the uncovered warmed up more and hence, reduced the rate of heat loss when compared with the covered. Even with a black surface toward the sun, the covers did inhibit heating of the hutches, but calves would be able to move into the sun during those periods. Improved materials and designs for hutch covers are presently being developed.

Key Words: cold stress, dairy calf, hutch